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A COMPLEX SPATIAL SYSTEMS ANALYSIS OF TOURISM AND URBAN SPRAWL IN THE ALGARVE

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Abstract

In recent decades, Europe has experienced an unprecedented urban growth affecting fragile ecosystems and natural habitats. Urban development in coastal zones, combined with city expansion, has led to irreversible adverse consequences for land use and to environmental degradation. The delicate balance between stability in urban areas and biodiversity, in both urban and rural areas, relates in essence to sustainability and economic development. This economic development in southern Europe is especially affected by service industries such as tourism. Preventing land-use degradation and environmental change is of the utmost importance for land-use management. This is particularly necessary in coastal zones, where contributing factors of a human (e.g. land-use change, pollution) or natural (e.g. erosion, changes in sea level) kind require important strategies to be designed for regional and urban planning. As the basic objective of sustainability and coastal management is the transmission of environmental assets to future generations, it is imperative to take into consideration the dimension of urban change and its impacts on the landscape in relation to socio-economic driving forces. The application of the spatial realities of land use within temporal dynamics allows the ex-ante assessment of spatial planning policies. Such impact assessments have become important tools for the supervision of decision making within land-use dynamics. The combination of economic, social, and natural consequences questions the application of complex systems theory within spatio-temporal dynamics in supporting regional decision making. In this context, Geographic Information Systems (GIS), combined with spatial data inventories, can provide a more accurate representation of the dynamics of urban change within land-use dynamics as part of complex systems. This paper proposes an analysis of the impact of tourism as an attractor of urban growth, leading to the loss of rural agricultural land use. By using spatial data inventories retrieved from the CORINE Land Cover Project in 1990, 2000 and 2006, this paper analyses urban sprawl tendencies associated with coastal tourist attractors. Mass tourism is defined in terms of weak and strong sustainability, depending on the distance of urban sprawl to tourist points of interest. While the ecological objective is to recognize the importance of balancing urban and rural choices within spatially sustainable land use, from an economic perspective, the lack of equilibrium in urban tourist choices underlines the need for better management of the service sectors in coastal regions.

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1. Complexity and urban growth: a reflection

'Complexity' has become a buzz word as an alternative way of looking at and researching contemporary environmental issues, especially where social and ecological processes are simultaneously at work (see, e.g., Newman, 2005; Reggiani and Nijkamp, 2009). This terminology has been used alongside other vocabularies such as study, research, science, and theory (e.g. Ruth and Coelho, 2007; Baynes, 2009). The concept of complexity is, however, still evolving, and no consensus has yet been achieved regarding its definition. That said, in general, complexity examines phenomena of concern in the context of evolving, multi-agent and non-linear dynamic systems. Nevertheless, the notion of complexity in this sense should not simply be regarded as meaning `complicated´ (Cilliers, 2005; Stewart, 2002). Cilliers (2005) further warns that complexity theory is far from prescriptive in terms of the specific methods that can be used to study complex systems; instead it offers a useful framework to approach the phenomena of interest from a more holistic perspective. It is noteworthy that the foundations of complexity theory in the social sciences were already laid by Nobel laureate Herbert Simon in 1958.

Complex systems constitute heterogeneous agents linked with one to another and with the environment where they are situated by various interdependent relationships and interactions (Taylor, 2005). Such interdependencies are dynamic in nature both spatially and temporally, underlie non-linear processes and mechanisms with feedback loops shaping the systems, and collectively result in identifiable patterns at the macro- or aggregate level (Taylor, 2005; Newman 2005). The resulting observable patterns are contingent on the historical trajectory of the systems and do not readily lend themselves to conventional predictive techniques (Berkes et al., 2003; Axelrod and Cohen, 2000).

Both the social and biological components of the systems, together with the interdependencies and processes driving these systems, are embedded in "hierarchical, nested structures" (Parker et al., 2003). Consequently, each individual agent or component contributes to the whole dynamics of the systems and is affected by others at different spatial scales (Parker et al., 2003). In fact, one of the most important

characteristics of complex systems, in addition to their capacity to self-organize, is that the outcome patterns surfacing at the aggregate level do not simply mirror the elements of the systems added together, a characteristic known as “emergent properties of complex systems” (Baynes, 2009). Since interactions between the diverse components are so important, complex systems cannot therefore simply be decomposed into their constituent components and associated behaviour, each to be examined in isolation (Urry, 2005). In short, complex systems are distinguishable from others, in that these systems are characterized by several critical features, including non-linearity, uncertainty, emergence, multiple scales, and self-organization (Anderson, 1972; Bertalanffy, 1950; Berkes et al., 2003).

The directions towards which complex systems are heading are determined by how strong the dynamic relationships are that exist between the components (agents and environment) that make up the systems. It is important to note that complex systems may entail not a single equilibrium but often multiple equilibria. Stable or equilibrium states are likely to emerge from strong relationships, temporarily changing but with persistent patterns of organization, and are normally associated with systems that have moderate relationships. At the other end of the continuum, systems that have weak relationships tend to be vulnerable to disruption and, in turn, the effects are not easily observable (Parker et al., 2003).

Given the nature of complex systems, it has been increasingly advocated that conventional analytical and statistical methods alone will not suffice to investigate such systems (Parker et al., 2003; Baynes, 2009). Alternative tools are becoming available which have the capacity to explore the processes underlying the complex systems under examination and to identify patterns resulting from such processes. In other words, these are tools that can be used to both understand the non-linear behaviours of complex systems and the observable patterns that emerge from such behaviours. The ability of the tools to capture both spatial and temporal complexities thus becomes imperative. Increasingly fashionable are those tools that can be used not only to reconstruct past phenomena and to understand the present situation but also to explore future spatial possibilities. The latter, in the presence of many risks and

uncertainties inherent in almost all complex systems, arguably has a unique place in both academic and applied areas. Promising alternative tools include, among others, network analysis, system dynamics, cellular automata modelling, agent-based modelling, and multi-agent system modelling (Baynes, 2009). The last three approaches are gaining increasing acceptance and popularity among researchers dealing with complex systems that involve both social (human) and ecological interactions because of the capacity of the tools to capture human decision rules and to represent the interactions and the resulting phenomena in spatially explicit ways at various temporal scales (see also van Leeuwen et al., 2007).

Reflecting on the brief discussion on complexity and complex systems above, urban growth can be viewed as both a process and the resulting patterns of complex systems. Various characteristics of complex systems are self-evident when one closely examines the phenomenon of urban growth (see also Batty, 2007). To begin with, urban growth involves heterogeneous agents (policy makers, business players, residents – to name a few) that are interdependent, and whose dynamic interactions over time at multiple scales make what a given urban area looks like today. An array of factors influence and shape urban growth ranging from biophysical constraints, existing infrastructures, technological advancement to the conflicting social, economic, and political interests of different agents (stakeholders). As these three elements continuously change (especially human aspiration), managing these in the long run may become problematic, and complexity theory has something to offer (Ruth and Coelho, 2007). As Zahra and Ryan (2007) put it, complexity theory offers “a language” that can be used not only to examine the components but also any changes involved. In similar vein, by embracing complexity theory it is possible to even link the notions of both space and place in geographical studies (Portugali, 2006). On the other hand, a growing body of insights from urban studies has further refined complexity theory (Reggiani and Nijkamp, 2009; Wilson, 2006).

Micro-level interactions between the heterogeneous agents and with the environment result in patterns of expanding urban areas following particular rules – in this paper, for example, these rules are linked with the presence of focal points of tourism

attraction and the associated infrastructures. By carefully exploring processes that underpin urban growth, it is possible to generate insights into what forces drive urban growth from the past to the present, and into the likelihood of future trends by using spatially-explicit cellular-automata-based models (see, e.g., Silva and Clarke, 2005). The aim of this paper is to illustrate the importance of complexity concepts by presenting the findings from a spatial dynamics exploration of the impact of tourism in the Algarve in Portugal as an empirical case.

2. The Algarve region – From past to present

The southern region of Portugal, known as the Algarve, shares unrivalled geographical and topological characteristics, recognized since pre-Roman civilizations (Gamito, 1997). Since Antiquity, the Algarve has been a trading route to the Mediterranean and Northern Africa, enabling a diversity of cultures to develop within the region (Strabo, 2007).

With an advanced cultural Neolithic presence (Nocete et al., 2005), as well as the existence of several Bronze Age settlements, the Algarve has aroused interest from archaeologists from the beginning of the XIX century onwards. One of these was Estácio da Veiga who very actively reported a huge amount of findings which were the basis of an important regional archaeological volume called “Antiguidades Monumentaes do Algarve” (Veiga, 2005).

The Roman period in the Algarve is quite well documented and even today is represented by certain Roman villas and sites, as well as by the many *cetarias* (fish-salting tanks) abundant in most of the coastal areas. Roman Algarve, in fact, still continues to intrigue archaeologists who are attempting to better understand the importance of the Algarve in the context of the former area of Lusitania, which prospered greatly at the time of Augustus until the end of Antiquity.

Known Roman cities such as Ossonoba, Baetica and Balsa, as well as the ruins of Milreu, show a very high level of cultural and social development, most probably directly

related to the economic prosperity of those times, which is also observable in the richness of the Roman mosaics that are abundant in this area.

Nowadays, diverse tourist attractions are at the heart of the historico-cultural and natural narrative of the region where urban sustainability must be considered (Vaz and Nijkamp, 2009). The Algarve is bathed by the Atlantic Ocean in the South, and a well-defined mountain range in the North separates it from the region of the Alentejo.

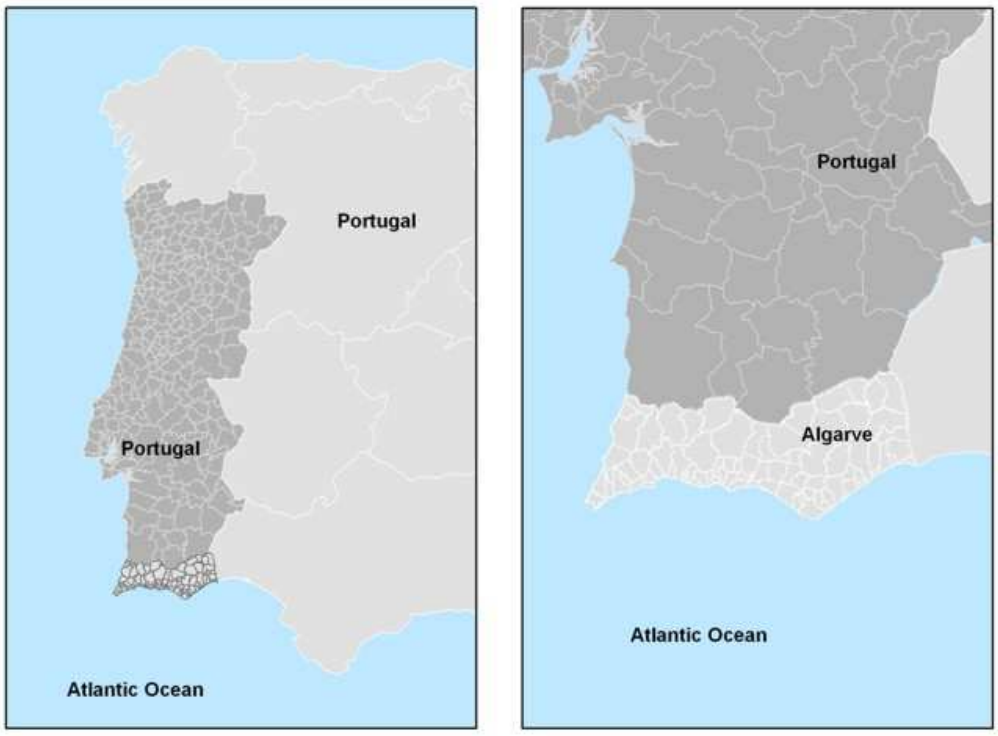

Figure 1 – Location of study area

The study area is in the Southern part of the Algarve, and comprises the farthest south-eastern part of the Portuguese mainland (Figure 1). This coastal area borders the Atlantic Ocean to the South, and to the East it is separated from Spain by the River Guadiana. To the West, the limits of the study area are defined by the location of one of the most popular tourist cities of the Algarve, the city of Portimão, whose tourist activity has greatly expanded over the last 30 years.

3. Urban growth, tourism and sustainable challenges

In the early 1960s, poor legislation and inadequate urban planning led to uncontrolled mass tourism industry in the Algarve, where to meet the demand, hundreds of new tourist infrastructures (e.g. hotels) were built, generating considerable revenues for this region. However, these infrastructures were poorly planned, and often located within coastal areas to increase the spatial proximity to areas of tourist interest. As a result, there has been an increasing concern about mass urbanization in the Algarve, especially in the region of Faro, where at present an International Airport facilitates a massive influx of tourists from northern Europe, which, in the peak summer period, is as much as ten times greater than it is in the winter season.

The circular flow model proposed by Tribe (2005) shown in Figure 2 clearly focuses on the consequences of tourism and the use of sinks/sources relating to environmental capacity. The circular-flow model shows the consequences of permitting the accumulation of wealth from the production of goods and services and the exploitation of resources.

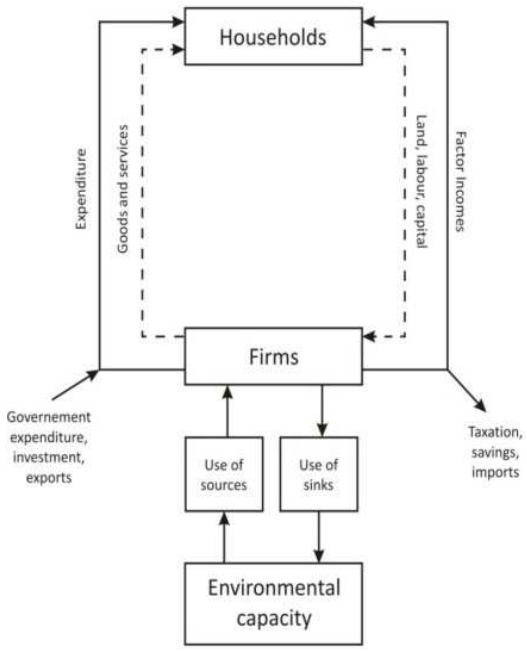

Figure 2- Environmental capacity circular-flow model

The relationship between the production of goods and services and the utilization of resources necessary for this, combined with the scarcity of resources, defines the resilience of the environment. Such economic activity inevitably leads to land-use change, pollution, and the vulnerability of ecosystems, and thus sustainability becomes unavoidably compromised.

The vulnerability caused by land-use change and generated throughput from economic activity within the tourist industry is jeopardizing natural landscapes and ecological habitats, resulting in a number of worrying consequences for the social and natural dimensions of the Algarve. Although the Portuguese PROT (Plano Regional de Ordenamento do Território – Portuguese Regional Territorial Plan) designates the use of specific areas only for tourists, existing urban areas are located within specific protected areas such as the *Parque Natural da Ria Formosa* (the Formosa estuary Nature Park), an ecological lung for the wildlife of the very fragile wetland bio-habitats. Population increase and infrastructures generated in response to tourist activity may therefore pose serious dangers for future land sustainability in the medium/long run, if no measures for more sustainable choices – such as ecotourism – are taken. Clearly, the argument for tourism within a regional planning perspective involves the utilization of sustainability strategies in which both weak-sustainability and strong-sustainability options should be considered.

In this context, and given the problems of land-use sustainability that the Algarve is currently facing, GIS-based research may help to shed some light on future planning strategies, by combining available tourist information within implicit land-use change models. The spatial complex systems literature applied to land use change models (Clarke and Hoppen 1997, Syphard et al., 2004) strongly recommends the use of Euclidian distance factors (urban proximity, road proximity), as well as morphological characteristics (slope, land use) for predicting urban growth, which is stochastically assessed. As tourism seems to be a key growth factor in the Algarve region (Guerreiro et al., 2008), distance from the International Airport of Faro was also taken into account. Social leverage was analysed using Census data per municipality. Table 1 illustrates the data inventories used for the creation of our urban growth model. These

data inventories are separated into different layers which allow the weighting process within a known spatial projection.

Table 1 – Spatial data for the urban growth model

Data Layer	Source	Original Projection	Used for
ENVIRONMENTAL DATA			
Algarve DEM 90m resolution	SRTM (Shuttle Radar Topography Mission - NASA)	UTM	For creation of slope
Slope	SRTM (secondary data)	Lisbon Hayford-Gauss	Significant Layer for APM
Portuguese Administrative Chart	Portuguese Geographic Institute	Lisbon Hayford-Gauss	Definition of Municipality and *Freguesias* Boundaries
Land Use for Portugal	Requested from Portuguese Environmental Institute, belonging to CORINE Land Cover 90 and 2000 Project.	Lisbon Hayford-Gauss	Significant Layer to understand land use / land change between CLC 90 and CLC2000
Roads	Digitized on screen from Carta de Portugal Digital 1:500000 scale – Portuguese Geographic Institute	Lisbon Hayford-Gauss	Road distance is critically analysed as an important factor for network proximity between Faro and Olhão
SOCIAL DATA			
CENSUS 1991 and CENSUS 2001	National Institute of Statistics (INE)	No Projection	Used to balance weight factors among *freguesias* and tendencies of growth

4. Land-cover map and urban growth in the Algarve

A land-use/land-cover map enables us to “assemble far more knowledge about the Earth than is possible on our own” (Longley et al., 2006). Such a map provides a large quantity of information which can be regarded as a spatial data infrastructure, that supports the spatial, temporal and thematic data sets which represent the real world (NCGIA, 2000).

The choice and adequacy of the data used, depends on the scope of analysis, and should be considered carefully, as there are many different types of data sets (e.g. the urban areas of the Algarve) which can be used to represent our study area. In establishing evaluation criteria, the following criteria should be considered as relevant for urban propensity modelling within the Algarve: (1) Thematic scope: Urban areas in the Algarve region should be represented with as few errors as possible, and all the different types of land use of the region should be analysed. (2) Spatial scope: The area represented should focus on the coastal nature of the study region. (3) Temporal scope: The answers should not apply only to one static temporal moment, but rather,

to a time period that provides at least two points in time (preferably three for validation) to facilitate the analysis of urban area dynamics.

Combining these criteria is not easy, as land-use maps are used for many different purposes and no *prêt-a-porter* situation exists. Thus, three land-use databases available for the Algarve region were analysed, so as to assess which has the most suitable characteristics to study urban growth. Key aspects that are needed are: up-to-date and accurate data at regular intervals of time on the changing urban sprawl, urban land use, urban resources, and, the urban environment (Maktav et al., 2005).

The creation of land-use maps has been largely documented, and, in areas such as remote sensing, is very important and widely studied. Nevertheless, if we were to create our own land-use maps, besides taking a very long time and much financial expenditure, this would not alter the results significantly. This is mainly due to the size of our area of study, in which spatial accuracy is not required as much as the overall notion of changing patterns. Thus, instead of technical accuracy, the regional adequacy of the chosen variables, as well as accurate notions of current development, are important aspects.

The CORINE Land Cover (CLC) project started on 27 June 1985, in order to address the following issues: state of individual environments; the geographical distribution and state of natural areas; the geographical distribution and abundance of wild fauna and flora; the quality and abundance of water resources; the land-cover structure and the state of the soil; the quantities of toxic substances discharged into various environments; and a List Natural Hazards (EEA, 1996). In this sense, CLC can be seen as ”an experimental project for gathering, coordinating and ensuring the consistency of information on the state of the environment and natural resources in the Community” (85/338/EEC, Council Decision 27/6/1985).

The primary source of information for the CLC is satellite imagery which is represented at a 1:100,000 scale with a 25 ha minimum mapping unit (MMU). Using the MMU means that features smaller than 25 ha or 100 m (hedgerows, etc.) are generalized in the CLC inventory (Paínho and Caetano, 2006). However, these elements are important

structural elements of certain landscapes, essential in ecological terms and an inherent integrated part of their character and visual appearance. In this "(…) sense the results presented give only a broad picture of the countryside." (European Community, 2000). The MMU is a key aspect to be chosen when undertaking the creation of a land use map. The question is whether CLC with an MMU of 25 ha may be accurate enough for urban growth analysis in the Algarve region. After all, existing urban areas of a smaller dimension than 25 ha may be unrepresented, and this could lead to a misleading and inaccurate representation of the urban growth phenomena. One of the solutions would be the use of a different land-use inventory which would have different temporal moments as well as a smaller MMU, or simply making a land-use map with a smaller MMU that assessed urban areas more accurately. A significant venture is the MURBANDY (Monitoring Urban Dynamics) project, and, as this project covers a long enough period of time, it becomes possible to know how cities have grown in the past (Maktav et al., 2005). The MURBANDY analyses urban dynamics in the coastal region between Albufeira to Vila Real de Santo Antonio. For an integrated tourism analysis however, as suitable as this project is for local spatial assessment, the study area was considered too small. Nevertheless, the project MURBANDY Algarve (Caetano et al., 1999) shared important information concerning urban environmental change and covers the period of greatest tourist development in the area. This led us to consider that carrying a regional study of urban and touristic dynamics would be of great interest. The problem concerning the MMU reported in CLC, was equated by building a comparative qualitative assessment of the main differences between the two projects. While MURBANDY supported higher resolution for urban strata, many urban changes do not fall into the coastal region studied within the MURBANDY framework, thus making CLC a better choice for regional analysis.

5. Urban growth in coastal areas facing a mass-tourism industry

As discussed above, the Algarve is the most southern region of Portugal, and it has a very heterogeneous morphology. Because of this heterogeneity the Algarve is a region

of unrivalled ecological beauty with interesting eco- and cultural tourism opportunities which generate economic prosperity.

However, as mentioned earlier, the Algarve was confronted with an unprecedented interest from the tourist industry in the 1960s, which led to the expansion of the built-up area of the coastal cities. These became major foci for mass-tourism, testing the resilience of the spatial environment, as well as creating the problem of how to cope with economic prosperity, without depleting and exploiting the available resources. The demand generated increasing economic prosperity, and nowadays the region is still one of the wealthiest areas of continental Portugal.

However, the winter population of the Algarve is a tenth of what it is in summer, leading to several social problems, regarding stability within the region in terms of economic welfare, combined with the problem of maintaining existing infrastructures for quite a short period during the year. Tourism, as such, seems to bring forth both a symbiotic and an antagonistic relationship, in which economy and ecology (Archibugi et al., 1988) are key aspects, and the criteria of sustainability then become a decision factor (Buhalis and Fletcher, 1995) in tourism.

Figure 2 shows the urban dynamics calculated by the CORINE Land Cover Project project for 1990, 2000 and 2006. Between 1990 and 2000, the areas under urban land use clearly doubled, and were mainly concentrated in the western region, between the district capital of Faro, the location of the international Airport, and the city of Portimão, currently the most touristic parts of the Algarve. While up until 1990 urban land use seems to have been relatively balanced between the seashore and the interior of the study area, from 1990 onwards, there was a strong development of the built environment along the coast, especially in main cities. This tendency reflects the increasing tourist demand in the region, where several infrastructures were created at the beginning of the 1980s to cope with the demand dor mass tourism. The figure includes the study region of the CLC Project, as well as the existent urban land covers for 1990, 2000 and 2006 in the region of study.

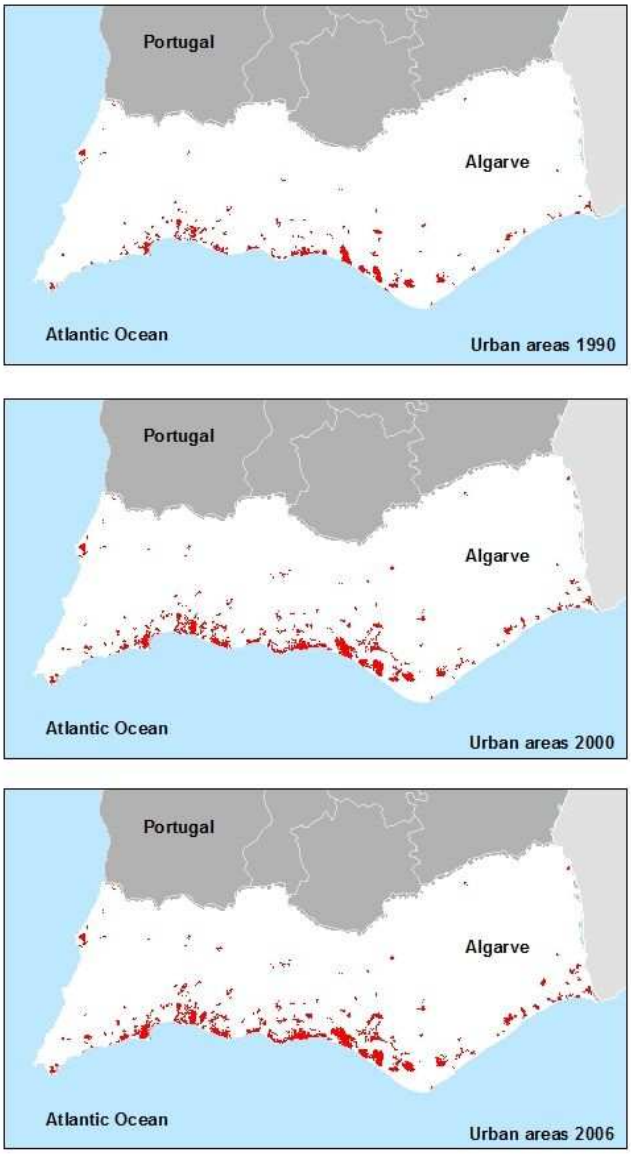

Figure 2 – Urban land use in the Algarve in 1990, 2000 and 2006

The calculation of the Euclidean distance allowed us to assess the spatial proximity of urban areas which have the propensity to become tourist attractions. As demonstrated by Figure 3, the number of tourist points of interest (POI's) seems to be greatly influenced by urban proximity. The tendency is strongly related to the greater proximity to tourist POI's within urban perimeters, but these POI's decrease over distance. However, after a distance of 5 km, the tendency seems to reverse, and again, more tourist attractions are found. This allows us to conclude that: (i) urban proximity

seems to be directly related to tourist attractions in the study area, but (ii) after a certain distance, this tendency reverses indicating a different situation based on rural/hinterland tourist attraction; and (iii) tourist POI's, other than those of cultural and natural heritage, are built in proximity to cities to allow easy access.

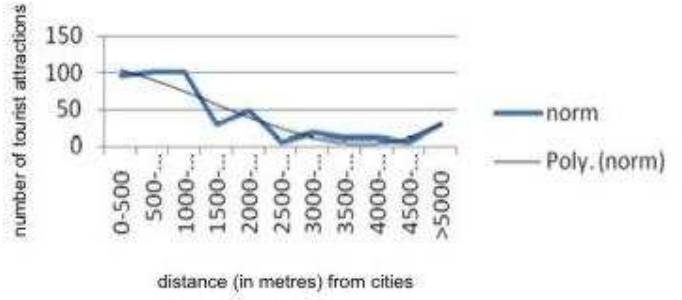

Figure 3 – Tourist attractions and distance from urban areas

A high density of tourist POI's also seems to exist close to coastal areas. This proximity is related to the location of urban nuclei within coastal regions. The information on the distances from urban areas to tourist POI's, as well as distances to the coast, has enabled us to generate a propensity map based on normalized weight factors. The Portuguese Tourism database comprises a total of 92 points for the study area focusing on: poles of touristic attraction as infrastructures (golf courses, hotels, etc.); natural landscapes (river basins, natural reservoirs) and cultural heritage (churches, archaeological sites, museums etc.). In addition, urban change within the study area was assessed for 1990, 2000 and 2006. As mentioned earlier, from the 1990s to 2000, this specific spatial segment in the Algarve has experienced the most urban change, as well as tourist growth.

The accuracy of the propensity reached 83 per cent, confirming the calculated suitability and quantifying the propensity of urban proximity to tourist attractors. Tourist attractions showed a tendency to be located in the vicinity of urban areas and along the main transport networks within the area of study. The existing networks play a central role in the spatial location of POI's. While most cultural heritage POI's are

positioned within the cities, tourist infrastructures constructed in more recent years are found in the coastal areas.

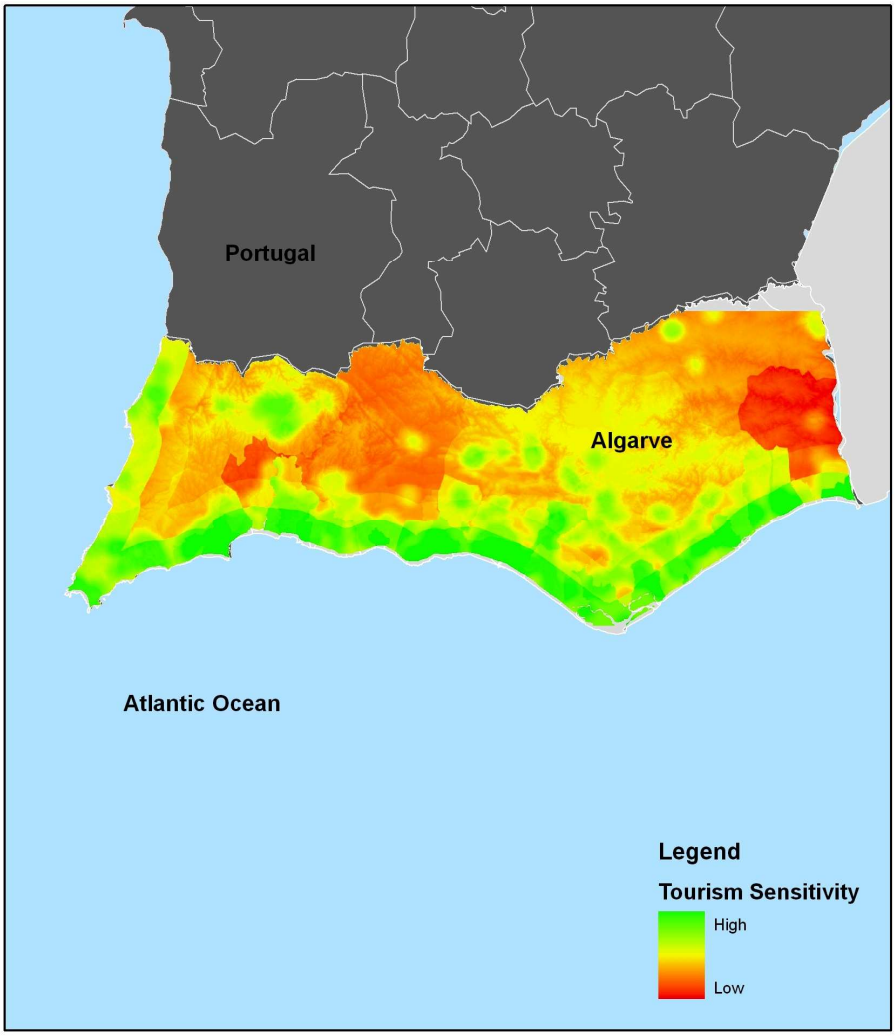

Figure 4 – Tourism propensity map with location of tourist attractions

6. Urban growth, tourism, and sustainability

Tourism undoubtedly brings with it a wide range of social and economic benefits - to name but a few: it opens up access; facilitates development through the provision of infrastructures; creates employment; encourages links between global societies; brings in revenue to the local authority (see, e.g., Minciu, 2008). However, in the absence of

vigilant long-term planning, numerous undesired impacts can arise and disrupt the biophysical and social systems in which the tourism is embedded, and can further cause negative impacts that can be too costly for both the environment and society to bear. The pervasive consequences of throughput caused by economic growth are manifold, ranging from its direct impact on natural environment (Copeland and Taylor, 2004) to its implications for both society (Hirsch, 1976) and governance (Paavola, 2007). As mentioned by the European Environmental Agency (EEA, 2006a), in the Costa Vicentina and the Algarve: "(…) *artificial areas have been increasing and agricultural lands have been decreasing for both the designated site and its surrounding area between 1990 and 2000. Interestingly, in relative terms, the protected site has experienced slightly faster growth of artificial areas and slower abandonment of agricultural land than the areas around it."* Yet, in the context of tourism as a driver of economic development, it is a very challenging task to examine whether the environmental and social costs far outweigh both the financial and the non-monetary benefits that tourism actually generates (Minciu, 2008).

Coastal areas such as the Algarve with various tourist attractions within and close by certainly exert a strong pull for the expansion of built-up infrastructures and thus of urban areas. Such development, if it continues in an uncontrolled manner without carefully taking into account the capacity of the biophysical environment, will make the environment vulnerable to degradation in the long run. In fact, urban pressure in coastal areas is necessarily more significant, because of land shortage, resulting in dense urban areas which lead to higher amounts of environmental pollution, loss of ecosystems, and gradual loss of biodiversity. Tourism, in general, and coastal tourism, in particular, have been proven to be one of the main generators of economic growth for the southern European and Mediterranean regions. However, because of the scarcity of available land, the carrying capacity of urban environments within coastal regions, is very limited. In this sense, if the intensity of tourists is not taken in account (Davenport and Davenport, 2006), the constantly increasing population will inevitably cause the loss of ecologically viable coastal areas (EEA, 2006b). Population increase is therefore a direct result of economic growth, but produces a number of negative

consequences for sustainable ecological development and healthy urban environments. Anthropogenic pressures from both visitors and local residents inevitably degrade the environment (e.g. accelerating sand dune erosion) and lead to overexploitation of scarce resources such as water (see, e.g., Garcia and Servera, 2003).

To mitigate the problems that cast a shadow over tourism economic activities associated with tourism, it is imperative, therefore, for the stakeholders involved in tourism to be aware that the pursuit of economic interest alone will in the short run compromise the long-term global sustainability of the area in the future. Government, the tourism industry, property developers, and businesses in general, non-governmental organizations and civil society, and the local residents, all need to work together in developing and implementing future plans that strike the balance between economic benefits and environmental conservation. They need to think of strategies that ensure that the current and future generations of the local population will continue to reap the benefits from tourism, while at the same time the local environment and the socio-cultural heritage are preserved (Turker and Dincyurek, 2007). Some studies (e.g. Li et al., 2006; Walpole and Goodwin, 2000) suggest that, with a sense of ownership from, and with active participation of, the local stakeholders (especially local residents) such sustainable tourism would provide a better development path for the future of the tourist industry and the society at large. What is more, in the context of the Algarve, there is considerable scope for the tourism industry not only to set its sights on the coastal zones but also to explore and tap into opportunities to enjoy the beauty and tranquillity of rural landscapes. Efforts devoted to this should, however, ensure that tourism goes hand in hand with the impetus to care for the local environmental and the socio-cultural resources base from now into the future. Potentially, such an alternative tourism perspective would have positive knock-on effects in forging and refreshing the linkage between rural and urban areas in mutually beneficial ways. Only then can tourism, by sustaining the urban areas and reinvigorating the rural ones, deliver its greatest contribution to sustainability at least within the socio-geographical limits of the Algarve.

Furthermore, rural and urban dynamics must face the inevitable issue of choices and sustainability. The carrying capacity of land use within coastal areas is becoming diminished as a result of both the expansion of urban areas, and the erosion of coastal zones. The management of certain services, such as tourism, must be rethought for future generations. If not, natural and fragile landscapes located in southern Europe and with a strong tourist industry might be lost forever. By acknowledging tourism as an attractor for urban growth, the 'enlarging Europe' must make the choice between growth and development. However, whatever may be the economic growth of the tourist industry within coastal regions, the scarcity resulting from its impact on the carrying capacity of such areas calls for a new kind of perception of economic opportunities. Mass tourism has been shown to be a handicap for sustainable spatial development and, within such a context of urban growth, it is of the utmost importance to generate new tourist alternatives, related either to cultural heritage or to urban tourism, which do not compromise the available natural resources of those landscapes.

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